Dynamic simulation and optimization of a composting process for the minimization of waste and energy use

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Mathematical modeling has been widely used in science and engineering in order to allow an integration of knowledge on the different behaviors of systems, explore new theoretical concepts, predict system performance, and, in an increasing number of cases, aid in the solution of practical design problems. In this study, in order to minimize waste and energy loss, we developed a simulation and design system for the compost plug flow reactor by solving a set of differential equations simultaneously and comparing the efficiency of different type of reactors. Our study is based on basic principles of chemical reaction engineering: kinetics, stoichiometry, mass and heat balances. Depending on the design and operation of a composting process, the rate of decomposition can vary widely. Effective composting is achieved by providing optimal environmental conditions for composter. The effects of important factors influencing the rate and efficiency of composting, such as temperature, moisture content, carbon-to-nitrogen ratio (C/N ratio), pH level, aeration rate and physical structure of organic materials, were investigated to obtain the optimal operation condition of a commercial compost reactor.